The Effective Thermal Conductivity of Porous Media Saturated by Carbone Dioxide

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Investigations of the coefficient of thermal conductivity of porous media are carried out by the stationary method of the flat horizontal layer, with an uncertainty within 1%. Porous sintered glass materials are investigated. They are homogeneous and serve as a good model of different heterogeneous media. Experimental results are given for the effective thermal conductivity of the porous media with 16 μm diameter pores, fully saturated by carbon dioxide in the temperature range 290-360 K at pressures from 0.1 to10MPa. The samples had a diameter of 0.042m. and a thickness of 0.003055 m. The measurement of thermal conductivity was along isobars, including the critical isobar, at fixed temperatures. Firstly the glass samples were investigated with evacuated pores. We find that the thermal conductivity of the structure is increasing with the increase of temperature. The heat is transferring from one contacting surface to another by the phonons. The heat transfer by radiation, evaluated by well known literature formulae, was of little significant over this temperature interval and was omitted. The thesis was that the effective thermal conductivity of porous media, saturated by carbon dioxide, is mainly due to the thermal conductivity of the porous glass structure, where the phonon mechanism of heat transport takes place. It is shown that the thermal conductivity of the porous sample saturated by carbon dioxide is less than the thermal conductivity of the bulk glass. We think this can be explained by the increase of thermal resistance by the deformation of heat flow lines and their convergence to the points of contact of grains. The effective thermal conductivity of the porous media saturated by the homogeneous substance-carbon increases with temperature. The results of experimental investigation of thermal conductivity of porous media saturated by carbon dioxide are compared with the calculated data obtained from well-known literature equations. We have good agreement between the data and literature models.